Two important studies in plant ecology published in unexpected places

Roland M. Harper

Important botanical contributions occasionally turn up in non-botanical literature. Two such items, of considerable interest to ecologists, have been unearthed recently, several years after their publication, in the chemical and geological libraries at the University of Alabama. The first was brought to my attention by the professor of chemistry, and the second I came across in looking up literature for a geological bibliography.[1]

The first is by W. G. Bateman and Lansing S. Wells, chemists at the University of Montana, on Copper in the flora of a copper-tailing region, in the Journal of the American Chemical Society, **39**: 811–819. April, 1917. It deals with a copper smelter near Anaconda, Montana, and contains partial analyses of the ash of several plants growing in tailings and mine waters, with special reference to copper, which is well known to be very toxic to some of the lower plants. Considerable arsenic, antimony, zinc and other metals were found in the soils, and sulphuric acid in the water, which made a very unfavorable habitat for most plants, large areas being entirely bare of vegetation. But the willows (*Salix fluviatilis*) were not completely killed, and *Dasiphora fruticosa*,[2] *Rosa Woodsii*, *Agropyron lanceolatum*, and *Equisetum variegatum* stood the abnormal conditions remarkably well.

In the trees and shrubs the copper was found to be chiefly concentrated in the bark, as if that was the plant's best way of getting rid of it. All the plants that tolerated copper and the other metals named also grew in natural soils in the same neighborhood that contained no appreciable amounts of them.[3]

[1] Bibliography of Alabama geology. Geol. Surv. Ala., Bull. 42, pp. 59–116. January, 1935. This contains references to 15 papers on fossil plants, among other things.

[2] As most readers of Torreya doubtless know, *Dasiphora fruticosa* (formerly included in *Potentilla*) is a Rosaceous shrub, common in some of the limestone regions of northwestern Connecticut and adjacent New York, if it is all the same species.

[3] Another way in which copper smelting is injurious to vegetation, mentioned only incidentally by Bateman and Wells, is by producing sulphurous fumes. Around the smelters of Ducktown and Copper Hill, Tennessee, vegeta-

The authors acknowledged the assistance of Dr. J. E. Kirkwood (1872–1928), who was professor of botany at the University of Montana at the time, and referred to some previous studies, including one on *Polycarpaea spirostylis*, the so-called copper plant of Queensland.[4] There is a bibliography of 24 titles, about half of them foreign, and all lacking authors' initials and complete page numbers. The average year of publication of the papers whose dates are given is 1900.

The second paper of ecological interest is by Robert H. Cuyler, of the department of geology of the University of Texas, on Vegetation as an indicator of geological conditions, in the Bulletin of the American Association of Petroleum Geologists, **15**: 67–68, figs. 1–12. January, 1931. The work was done in the vicinity of Austin, where there are several different Cretaceous formations, all calcareous. A fault running approximately north and south near the city separates the Edwards Plateau on the west from the black prairie (a part of the coastal plain) on the east.[5]

The author recognizes eight different formations, mostly fairly hard limestones, in the plateau region, and four, mostly marls and clays, in the coastal plain. There is one half-tone illustration of typical vegetation of each formation, and lists of a few trees and shrubs characteristic of each, prepared with the assistance of B. C. Tharp, professor of botany in the same institution. The different formations in each group are so much alike that any one not a geologist would hardly notice the differences, but Dr. Cuyler has made some surprisingly definite

---

tion close by has been almost completely destroyed, and the effects on trees and crops have been noticed some distance into Georgia, which a generation or so ago caused some acrimonious discussions, and threats of litigation by Georgia against Tennessee. There seems to be little or no reference to this in botanical literature, and only a little in geological literature. See L. C. Glenn, Science II. **23**: 288. Feb. 23, 1906; also page 11 of my Natural Resources of Georgia (Bull. Univ. Ga., Vol. **30**, no. 3. Feb. 1930).

[4] They seem to have had only a second-hand reference to this, but the original study, together with an earlier work of similar nature not listed by Bateman and Wells, was cited by me in a paper on Vegetation and mineral deposits, in the Engineering and Mining Journal (New York), **112**: 693–694 Oct. 29, 1921. (Abstracted in the Literary Digest, Nov. 19, 1921.)

[5] For some earlier notes on the same neighborhood, by the present writer, with references to previous literature, see Bull. Torrey Bot. Club **47**: 295–297. 1920.

qualitative correlations between geology and flora, pointing out several cases of species present on one formation and not on neighboring ones. And if his studies had been quantitative and had included herbs, doubtless still other differences could have been found, for two areas might conceivably have the same species of plants on them, but in such different proportions as to give quite a different aspect to the vegetation.[6]

It happens that I made brief visits to Austin in the summers of 1918 and 1934, and took what notes I could on the vegetation near by, without suspecting any such definite correlations as Cuyler has made, but I have no reason to question the accuracy of his statements. However, it seems quite likely that if the same formations were traced to greater distances, and the vegetation on them studied in the same way, some exceptions to his correlations might be found. This is a promising field for future ecological work; and a revised geological map of the state, published since Cuyler's paper, should facilitate such a study.

University, Ala.

[6] See Ann. Rep. Fla. Geol. Surv. **6**: 175–180. Dec. 1914. Also Torreya **17**: 1 (footnote). Jan. 1917.